

Head circumference charts updated

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SUMMARY Head circumference measurements from birth to 7 years, obtained from longitudinal data on children born between 1970 and 1977, are set against those from studies made in the United Kingdom earlier this century. A positive secular trend is shown. The children's heads were significantly larger than those born in the same locality 25 years earlier. Growth charts should be updated, as necessary, with each succeeding generation.

The importance of plotting children's somatic measurements against the appropriate centile charts is now well recognised, and in the United Kingdom those provided by Tanner^{1,2} are the most widely used. For weight and height¹ these have proved invaluable, but there is some suggestion^{3,4} that children's heads nowadays may be larger than those represented in the comparable head circumference charts.² Data are presented from a longitudinal study of children born in Oxford during the 1970s and followed up to the age of 7 years.⁵ They are set against values derived from previous generations.^{2,6-8}

Sample and methods

The children were all born in Oxford hospitals during the period 1970 to 1977. They were participating in a study of the growth and development of infants with differing rates of intrauterine growth.⁵ The sample mainly consists of 270 children whose birthweights were within 2 SDs of the mean for gestational age and sex.⁹ They were normally distributed within these limits. Also included are seven 'small for dates' and seven 'large for dates' babies randomly selected from those born during the same period. All were white singletons without major congenital abnormalities. Eleven (4%) of these infants were preterm.

The mothers were interviewed personally, and their babies examined within four days of delivery by medical members of a small research team. The children were seen thereafter in their own homes at the ages of 2, 6, 12, and 18 months; 2, 3, and 4 years; and aged 7 years at school. The measurements were made under standardised conditions by the same small group of doctors who had seen them at birth. Head circumference was measured with a fibreglass

tape round the largest occipitofrontal diameter. The children were weighed naked (in a bowl until they could stand alone) on standard steelyard platform scales. Length was measured on a custom built board with a fixed steel measure. From age 2 years onwards a stadiometer was used for height.

Results

Head circumference measurements for boys and girls are given in the Table. The mean values are plotted against those reported from earlier United Kingdom studies in the Figure. The lowest curves are drawn from data on 1400 London children published by Myers in 1926.⁶ Their birth dates were not given. Low⁷ made a longitudinal study of the growth of children born in Aberdeen between 1923 and 1927. At all ages their heads were slightly larger than those in the London sample. An upward trend is again seen among the children in Westropp and Barber's Oxford study, who were mostly born between 1944 and 1948.^{8,10} The boys in our study have significantly larger heads at all ages ($P < 0.001$)

Table Head circumference from birth to 7 years

| Age | Boys | | | Girls | | |
|-----------|-------|--------|------|-------|--------|-----|
| | Mean | (SD) | No | Mean | (SD) | No |
| Birth | 35.25 | (1.30) | 154 | 34.60 | (1.21) | 128 |
| 2 months | 39.81 | (1.15) | 120* | 38.56 | (1.06) | 95* |
| 6 months | 44.37 | (1.25) | 154 | 43.02 | (1.19) | 125 |
| 12 months | 47.57 | (1.35) | 154 | 46.09 | (1.21) | 127 |
| 18 months | 48.98 | (1.42) | 150 | 47.59 | (1.27) | 123 |
| 2 years | 50.14 | (1.47) | 145 | 48.63 | (1.34) | 118 |
| 3 years | 51.39 | (1.46) | 143 | 49.82 | (1.42) | 113 |
| 4 years | 52.05 | (1.48) | 137 | 50.67 | (1.41) | 115 |
| 7 years | 53.26 | (1.51) | 80† | 52.12 | (1.36) | 62‡ |

* Reduced numbers due to late introduction of this examination.

† Some children were not yet 7 years old.

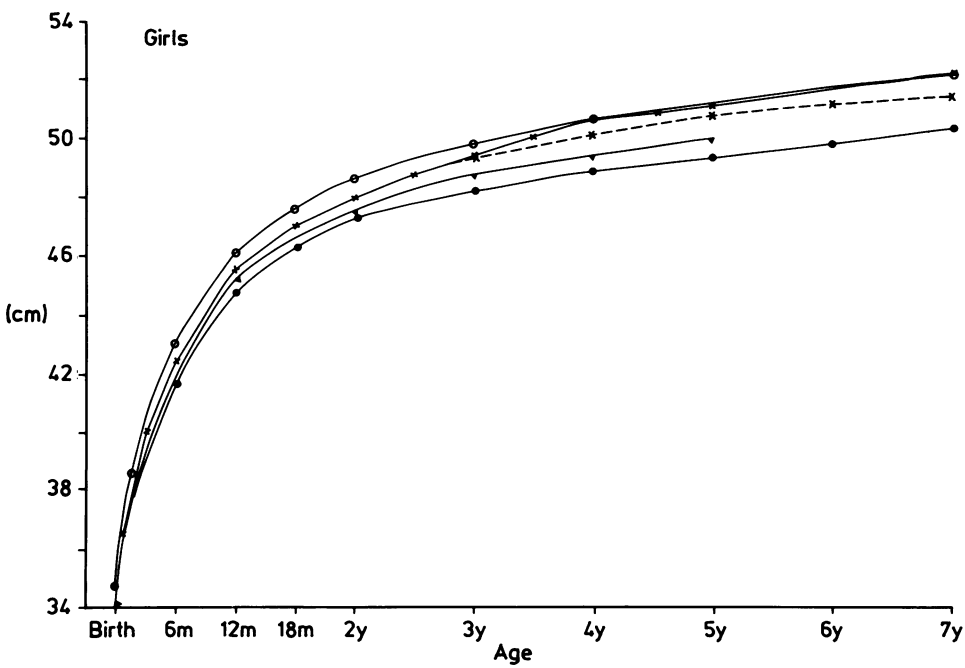
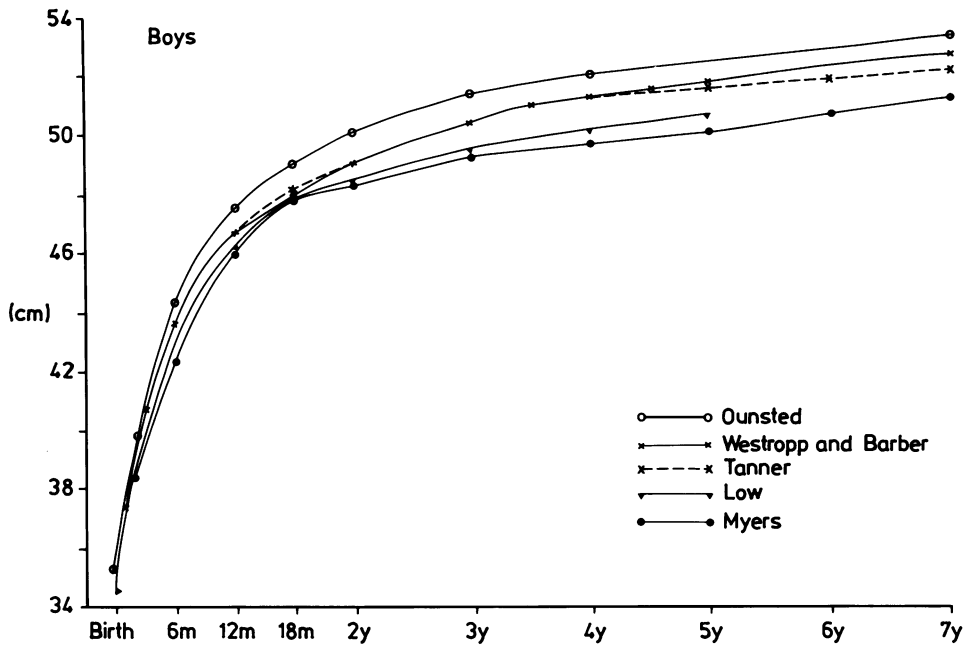


Figure United Kingdom studies of boys and girls.

than those born in the same city some 25 years earlier, and significant differences are also found between the girls up to and including the age of 3 years. Analyses of the weights and heights of children in the two Oxford studies showed very similar mean values at all ages with the exception of boys' height at 3 and 4 years; those in our study being slightly taller ($P < 0.05$ and $P = 0.05$, respectively).

Tanner² reports that his charts are derived from the data of Westropp and Barber, together with those drawn from the London Study of the International Children's Centre Coordinated Longitudinal Growth Studies.¹¹ The social class distributions in these two samples were similar,¹² and head circumference values up to 3 years were almost identical.¹³ No information is available on the London children, thereafter, but it is clear that from 3 to 4 years onwards the curves diverge, with the Oxford children having larger heads than are represented in Tanner's charts.

Discussion

In a separate study³ the head circumference measurements of 290 children born between 1970 and 1973 were distributed in centiles according to the standard charts.² At 12 months a generalised shift upwards was seen, with more than 60% of the values above the median. More recently Cater and Gill⁴ have reported on the head circumferences of 10 year old children born in Aberdeen in 1969–1970. Although half of them had been of low birthweight, two thirds of the whole sample had head circumferences above the 50th centile. Measurements for weight and height of the control children in this study were, however, very similar to those of the general population; and the centile frequency distributions were identical to those of the Tanner/Whitehouse 1959 standards. Thus, in two geographically distinct areas, and among children of different ages, their heads seem to be larger than expected.

Variation in the techniques of measurement is a possible but improbable explanation for these findings. Nor can the favourable locality from which our present data were drawn account for the children's heads being larger than the standards. As well as the earlier Oxford sample, data are available on children born in the early 1950s from two other sources. Head circumference measurements up to 3 years of age were very similar for children in west central London¹³ and Oxford,⁸ and those reported for Edinburgh children were substantially larger in the first year,¹⁴ but somewhat smaller from 3 to 5 years.¹⁵ The social class distributions of the children

in Westropp and Barber's sample differed slightly from our own. Although there were similar proportions in social classes IV and V, their sample had fewer children in I and II and more in III than ours. Statistical adjustments, however, to take account of this, only reduce the differences in mean head circumference by approximately 1 mm, and those of the younger generation remain significantly larger.

Many studies have shown secular trends towards increasing weights and heights during the past century.^{16–18} The changes were more marked for low than high income groups, and there was some indication that children in the latter had achieved their maximum size in the 1930s, when they were already taller than the general population in the 1960s.¹⁷ Cameron studied large cohorts of children's measurements obtained between 1904 and 1966.¹⁸ There was a fairly uniform trend upwards until 1949, but the median values for the 1959 and 1966 cohorts were 'almost superimposable'. The results, he said 'indicate an end to the positive secular trend for height and weight at about the same time as the previously reported end to a decreasing age of menarche in London girls.' Nevertheless, detailed examination of growth data on 15 birth cohorts from 1961 to 1975 showed a continuing positive trend for height among primary school children in England and Scotland,¹⁹ although at a slower rate than Cameron's estimates for any period between 1905 and 1954.

With small exceptions (which could have occurred by chance) the heights and weights of boys and girls in our study did not differ at any age from those of boys and girls born in the same city a generation earlier.¹⁰ The median values were also very similar to those in the standard charts,¹ but head circumference measurements were larger, indicating that the secular trend upwards in head size, which was evident during the first half of this century, continued into the 1970s. Among both English and Scottish school children the continuing trend for height during the 1970s was smaller for girls than boys.¹⁹ It was also greater when estimated at 8 years than at 5 years, suggesting a diminishing effect in the younger cohort. Bakwin and McLaughlin²⁰ examined the heights and weights of students entering college in 1930 and 1958, respectively. There was no change in those who had come from private schools nor among female students from state schools, but the height of male students from state schools increased during this period. These two studies draw attention to the likelihood of a gender difference in the time at which maximum height is achieved within specific populations. Our data also suggest that girls may achieve their maximum head circumference historically earlier than boys. Such a

difference would be compatible with the general theory of the Y chromosome message.²¹

One might conjecture about the underlying biological, sociological, demographic, and economic factors that may be associated with changes in size over time. It is important, however, to recognise that secular changes may still be occurring. Growth standards for children should be updated, as necessary, with each succeeding generation.

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